Biofouling Prevention Coatings

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At a Glance

What is it?

- Biofouling prevention systems protect the ship exterior by preventing marine organisms from attaching to — and damaging — the ship's hull.

How does it work?

- Biofouling prevention systems employ protective coatings that prevent barnacles, oysters, tubeworms and other marine life from attaching to the ship's hull. The Office of Naval Research is currently investigating two nontoxic biofouling prevention technologies including the Sharklet™ coating, which combines texture and antimicrobial properties to repel microorganisms, and mixed-charge compounds, which prohibit proteins and cells from binding to the ship exterior.

What will it accomplish?

- Environmentally safe biofouling prevention coatings will ensure peak ship performance, reduce the fuel consumption associated with excess ship weight and decrease the U.S. Navy's carbon footprint.

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Biofouling of ship hulls, primarily caused by the accretion of marine crustaceans such as barnacles and tubeworms, poses a significant impediment to ship performance. On its course, a ship can add barnacle weight at 150 kgs per square meter in as little as six months. The Naval Surface Warfare Center, Carderock, estimates that vessel speed is reduced by up to 10 percent from biofouling, which can require up to a 40 percent increase in fuel consumption to counter the added drag.

The Office of Naval Research (ONR) is investing in environmentally friendly coatings for ship hulls to prevent biofouling organisms from interfering with a ship's hydrodynamic performance. Previous biofouling solutions have included the use of biocides, which use toxins to kill organisms that try to attach to the hull.

ONR's research has yielded significant progress in the development of two powerful, nontoxic biofouling prevention agents. The Sharklet™ coating, developed in partnership with researchers at the University of Florida, mimics the inherent texture and antimicrobial properties of shark skin. Zwitterionic or mixed-charge compunds, developed in partnership with the University of Washington, manipulate surface environments at the molecular level to prevent proteins from binding to the ship's surface.

By reducing microorganism build-up, both coatings stand to substantially improve ship performance and fuel efficiency, while dramatically cutting fuel and maintenance costs. These coatings may also also reduce the transport of invasive species via ship hulls and eliminate the discharge of biocides into surrounding environments.

Additionally, researchers have determined that the ONR-funded marine biofouling prevention technologies also inhibit the growth of disease-causing bacteria. This unique attribute may have applications in the design of medical devices or hygienic surfaces found in hospitals and food preparation areas.

Research Opportunities:

- Novel concepts in design of coatings that are environmentally benign and will deter settlement of fouling organisms
- Understanding the settlement behavior and attachment of marine foulers
- Coatings that provide low adhesion of any fouling that occurs

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